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IS 14612 (1999): Commercial Burners Using LPG at Inlet Pressure up to 147.1 kN/m² (1500 gf/cm²) [MED 23: Domestic and Commercial Gas Burning Appliances]



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भारतीय मानक

147.1 कि न्यू / मी² (1 500 ग्राब/सैंमी²) तक के अंतर्गम दाब पर
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Indian Standard

**COMMERCIAL BURNERS USING LPG
AT INLET PRESSURE UP TO 147.1 kN/m²
(1 500 gf/cm²) — SPECIFICATION**

ICS 27.060.10

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Domestic and Commercial Gas Burning Appliances (Pressure Type) Sectional Committee had been approved by the Heavy Mechanical Engineering Division Council.

Liquefied petroleum gases are usually classified as butane, propane and butane-propane mixtures. The burners covered by this specification can be operated on butane, propane and butane-propane mixtures.

This standard is one of a series of Indian Standards on various domestic and commercial gas burning appliances (pressure type), used with LPG. For ease of reference this standard has been divided into three sections as follows:

Section 1	Construction
Section 2	Performance
Section 3	General

The relevant SI units and corresponding conversion factors are given below for guidance:

$$1 \text{ kg/cm}^2 = 0.98 \text{ bar} = 98.066 \text{ 5 kN/m}^2 = 14.22 \text{ psi}$$

$$1 \text{ Pa} = 1 \text{ N/m}^2$$

$$1 \text{ kgf/mm}^2 = 9.806 \text{ 65 MPa}$$

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

COMMERCIAL BURNERS USING LPG AT INLET PRESSURE UP TO 147.1 kN/m² (1 500 gf/cm²) — SPECIFICATION

1 SCOPE

This standard specifies construction and methods of test, for burners used by commercial catering organisations, using LPG at inlet pressures up to 147.100 kN/m² (1 500 gf/cm²).

For the purpose of this standard flow rate of all burners shall be declared at a pressure of 34.323 kN/m² (0.35 kgf/cm²).

2 REFERENCES

The Indian Standards listed below are necessary adjuncts to this standard:

IS No.	Title
319 : 1989	Free cutting brass, rods and sections (<i>fourth revision</i>)
554 : 1985	Dimensions for pipe threads where pressure tight joints are made on threads
1070 : 1977	Specification for water for general laboratory use (<i>second revision</i>)
2305 : 1988	Method for mercurous nitrate test for copper and copper alloys (<i>first revision</i>)
4218 (Parts 1 to 6):1976	ISO metric threads
5116:1996	Domestic and commercial equipment for use with LPG – General requirements (<i>fourth revision</i>)
6480:1988	Glossary of terms relating to domestic and commercial gas burning appliances

3 TERMINOLOGY

For the purpose of this standard, definitions given in IS 6480 shall apply.

4 TYPES OF BURNER

Each burner shall be designated with its type and flow rate. At present the following types are manufactured in the country:

- a) T22, T35, T50, T78;
- b) M22, M35, M50, M78; and
- c) V.

NOTES

- 1 Normally, the burners are rated at a pressure of 5 psi (34.323 kN/m² or 0.35 kgf/cm²). The flow rate of burner shall be declared at this pressure. The thermal efficiency test shall be carried out at this pressure, though the burner is capable of operating up to 1 500 gf/cm².
- 2 The prefix 'T' stands for torch type and the flame of this type would be longer (*see Fig. 1*). The prefix 'M' stands for 'Marguerite' and these burners produce a spreading flame in the form of a flat annular disc round the burner head (*see Fig. 2*). The prefix 'V' stands for its shape and these burners are linear and used horizontally. The 'V' type burner flame impinges on the bottom of a vessel or plate at an angle of approximately 45° (*see Fig. 3*).
- 3 The number following this prefix is the weight of the gas in pounds that would be flowing through the burner at 5 psi (0.35 kgf/cm²). The above nomenclature is in use in the country and had been adopted as such. The figures 22, 35, 50 and 78 mentioned after T and M are related to the gas consumption rate of the burner in kg/h at 1 500 gf/cm² (Maximum operating pressure). For example, T-22 means a torch type burner which gives a gas consumption of 2.2 kg/h at 147.100 kN/m² (1 500 gf/cm²). Gas burning rate of 'V' type burners of any length shall be 1.5 kg/h at a pressure of 0.35 kgf/cm².

SECTION 1 CONSTRUCTION

5 GENERAL

5.1 The construction of all the parts of the burners shall be sound and of high standard of workmanship and appropriate finish. The construction shall ensure durability and shall comply with the safety requirements.

5.2 Rivets, fastening screws, plugs, etc, shall not lead into gas passages, except where adequate provision has been made to ensure permanent gas-tight joints.

5.3 No pressure regulator shall be included as a part of the burner.

6 MATERIALS

6.1 The material used in the construction of the burner or parts of the burner shall be resistant to wear and deterioration occurring in the normal use.

6.2 All copper and copper alloy parts shall pass the mercurous nitrate test (season cracking test) when tested according to the method specified in IS 2305.

6.3 Non-metallic materials normally in contact with the gas shall not change in weight or volume by more than 15 percent after being immersed in pentane or LP gas for 72 h at room temperature, when tested according to Annex A

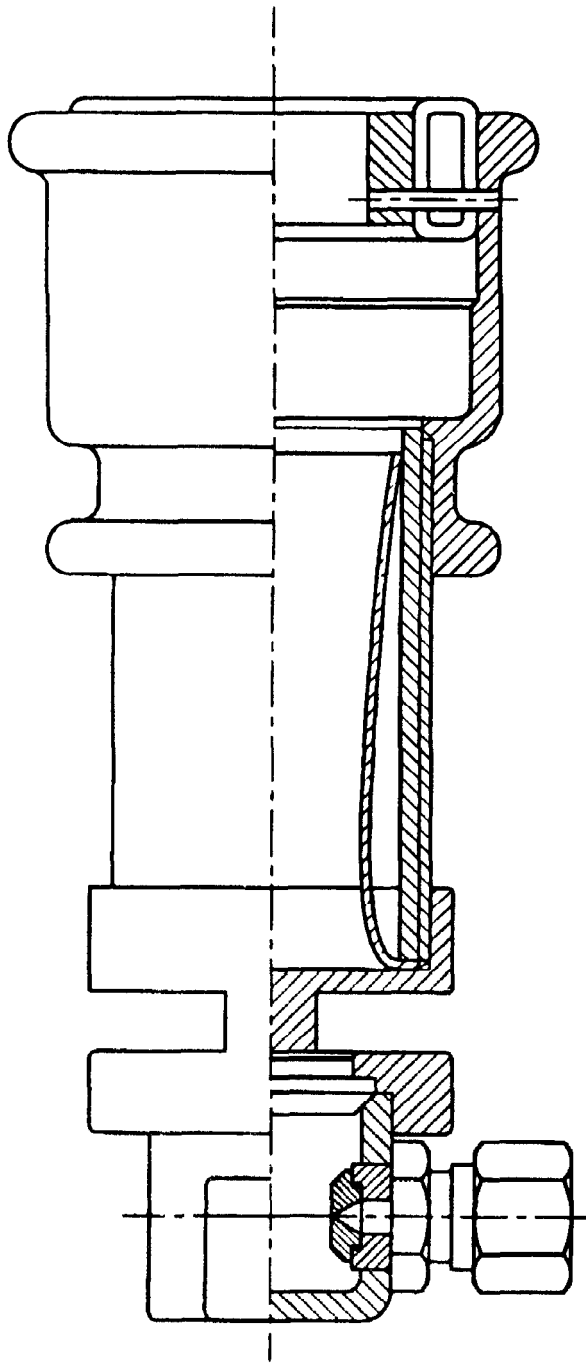


FIG. 1 T-TYPE BURNER (ASSEMBLY)

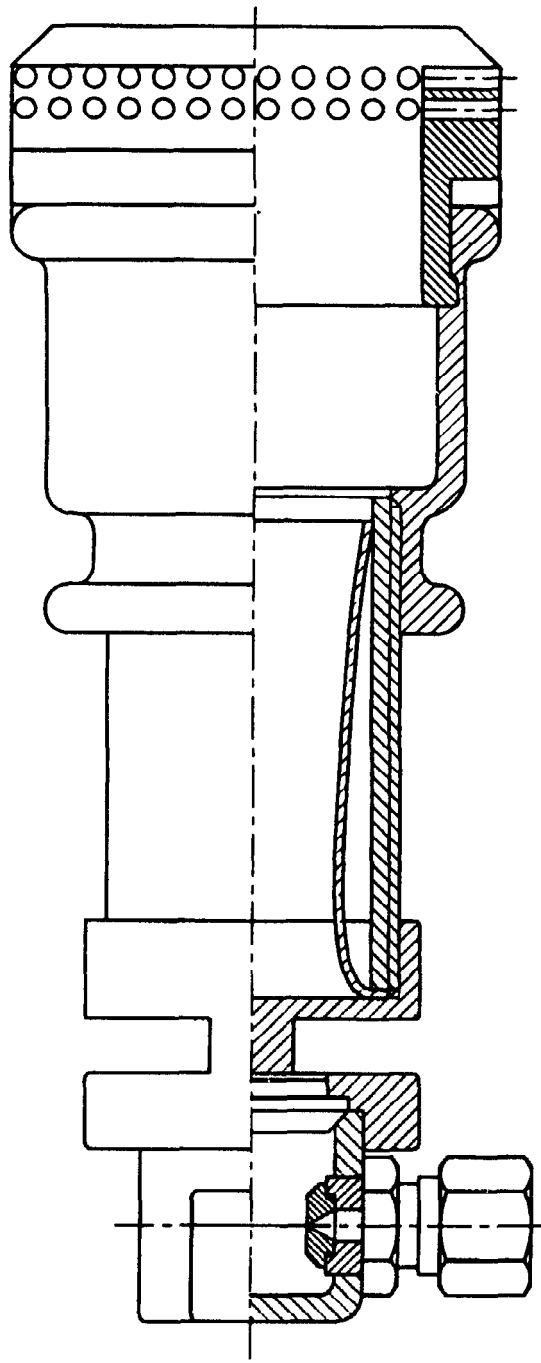


FIG. 2 M-TYPE BURNER (ASSEMBLY)

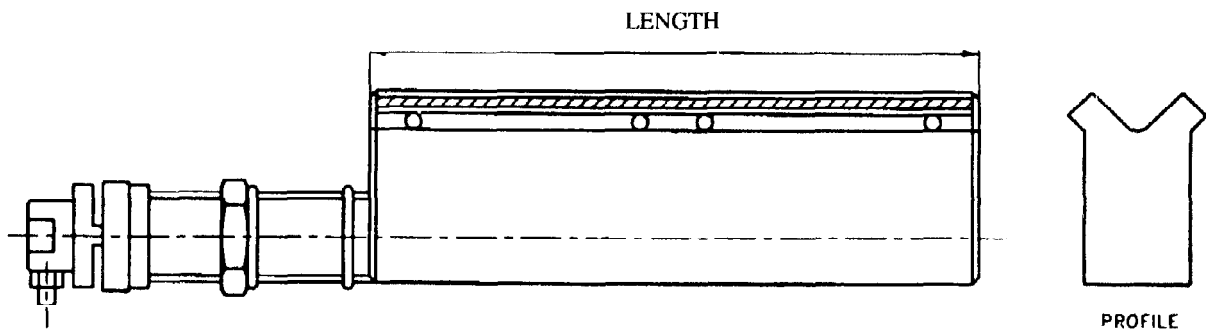


FIG. 3 V-TYPE BURNER

6.4 The main body of the burner (including mixer head, mixing tube and burner head) shall be of substantial and durable construction. Metals having a melting point below 510 °C shall not be considered acceptable.

7 DESIGN FOR MAINTENANCE

7.1 Every part of the burner shall be of such construction as to be secured against displacement, distortion, warping or other damage and shall be supported to maintain a fixed relationship and reasonable conditions of handling and use so as to ensure continued compliance with these requirements. Such parts not permanently secured shall be designed so that they cannot be incorrectly assembled and cannot be improperly located or misaligned in removing or replacing during cleaning or other servicing.

7.2 Burners and parts of the burners of same type, make, model and rating shall be interchangeable or replaceable without affecting performance.

7.3 The parts of the burner shall not become disconnected during operation.

8 STABILITY

The burner shall be so designed that it remains stable and shall not be easily overturned.

9 WORKMANSHIP AND FINISH

9.1 The finish of exposed parts shall be durable, easy to clean and not subject to excessive deterioration in normal use. Parts which come in contact with foodstuffs shall be capable of being hygienically cleaned. The finish shall, on visual examination, show no defects, such as pinholes, blisters, roughness and exposed areas of metal, which might give rise to undue rapid deterioration in the use. The surface shall also be free from burrs and sharp edges, which might cause injury to the user with normal operation.

9.2 Except for burners, all other parts, namely springs, screws, nuts and bolts, pipes, pins, etc, which can be removed for maintenance shall be of corrosion resistant material or treated to resist corrosion appropriate to the conditions of use.

10 INJECTOR JETS

10.1 The injector jet shall be fixed calibrated type. A jet plate having multiple jets shall also be permitted.

10.2 Jet plate holder shall be forged from wrought or extruded brass sections (see IS 6912).

NOTE — Inhouse forging facility is desirable.

10.3 The total flow through the jet(s) to the burner at 34.323 kN/m² (0.35 kgf/cm²) in kg/h of LPG shall be declared by the manufacturer.

11 BURNERS

11.1 The construction of the burners and the assembly shall allow their dismantling from the supports easily with or without the use of tools.

11.2 The burner supports shall be rigid and shall be fixed in their place. Their construction shall ensure the stability of the burners and shall prevent their undue movement in a horizontal plane.

11.3 The tightness of the joint from jet/jet plate to burner head in the burner assembly shall not depend upon adhesives or any kind of packing.

11.4 If primary air regulators are used, they shall be so designed that they are not easily maladjusted by the user and the construction shall be such that primary air adjustment can be made with the burner in place.

11.5 The burner or the appliances manufactured using these burners shall have a provision to protect from cooking vessels resting directly on burner top and smothering the centre flame.

12 GAS SOUNDNESS

The burner assembly from inlet to jet shall be checked at a pneumatic pressure of minimum 686 kPa (7 kgf/cm²) for leakage.

13 GAS INLET CONNECTIONS

The inlet to the burner shall be provided with an adaptor machined from extruded brass bar conforming to IS 319. The adaptor shall have threaded inlet configuration to suit the end connection of burner pigtail.

14 AIR ADJUSTER

Air adjuster may be provided so that the burner works satisfactorily within the pressure range offered.

SECTION 2 PERFORMANCE

15 GENERAL CONDITIONS OF TEST

15.1 During the tests the initial adjustment of burner shall not be altered unless specifically required in the test procedure. The burner shall be adjusted and operated in accordance with the instructions given or issued with the burner. Before any tests are made the burner shall be operated at its full working temperature for a sufficient period to remove any temporary protective coating, which might interfere with observations. The gas connections and system up to and including the burners shall be examined for leaks before and after test. The performance test results shall not be valid unless the system is sound. The burner shall be at room temperature at the start of each test unless otherwise stated.

15.2 The room in which tests are conducted shall be adequately ventilated but free from perceptible draughts. The gas/air shall be supplied to the burner through a control valve, an adjustable pressure regulator. A flow meter with a pressure gauge on its inlet shall also be included for gas consumption

test. The gas/air pressure shall be measured correct to one percent of the normal pressure rating of the burner.

15.3 Except where otherwise stated, the burner shall satisfy the performance requirements using LPG.

16 GAS CONSUMPTION

16.1 Burner shall permit a gas flow within ± 10 percent of the manufacturer's declared gas consumption in kg/h when tested according to 16.2.

16.2 The flow through the injector jet(s) at the normal pressure rating of the burner shall be measured with a gas flow meter using compressed air (free from oil/impurities) at room temperature and pressure. This value shall be converted to flow rate at 27 °C and 760 mm of Hg. Thereafter using 0.75 as multiplying factor, the value of air flow shall be converted to flow of LPG at 27 °C and 760 mm of Hg.

NOTE — For the above test, one litre of LPG = 2.46 g.

17 IGNITION AND FLAME TRAVEL

Burner flames shall carry across to all ports on the same burner under normal working condition from full gas rate to 75 percent of full gas rate at inlet pressure from 80 to 120 percent of the rated inlet pressure.

18 FLAME STABILITY

It shall be possible to operate the burner at full gas rate to 75 percent of full gas rate at gas inlet pressure from 80 to 120 percent of the rated inlet pressure without the flame either extinguishing, blowing off or flashing back and without the formation of soot.

19 FLASH BACK

A vessel large enough to cover the pan supports filled with water shall be placed on the burner under test. The burner flame shall be ignited while the inlet pressure is maintained at 80 percent of the rated pressure. Water may be added, if required to maintain the level. Gas rate recommended by the manufacturer shall be maintained for half an hour after which the gas input shall be reduced to 75 percent of the full gas rate and then brought back to the full gas rate. The operation shall be repeated five times. No flash back shall occur during the test.

20 FORMATION OF SOOT

A vessel large enough to cover the pan supports shall be filled with water up to a height of 50 mm and placed on the burner under test. The burner shall be ignited with the gas flow maintained at the full gas rate. Water may be added, if required to maintain the level. After one hour, no soot (unburnt carbon) shall have been deposited on the bottom of the vessel. This shall apply for inlet pressures of 80 and 120 percent of the rated inlet pressure.

21 RESISTANCE TO DRAUGHT

There shall be no extinction of the flame of the burner at rated gas consumption when the burner is placed in a normal (not localised) current of air with a velocity of 2 m/s, as measured with a rotating vane anemometer. The location of the burner relative to neighbouring walls and the direction of the draught shall be varied to correspond to likely conditions of burner installation. This shall apply for all inlet pressures of 80, 100 and 120 percent of the rated inlet pressure.

22 COMBUSTION

On no account the carbon monoxide/carbon dioxide ratio of exhaust gases, of burner operating at any consumption at which the flame is stable at gas inlet pressure up to 147.1 kN/m² (1 500 gf/cm²) shall exceed 0.02. The carbon monoxide and carbon dioxide contents of the products of combustion shall be determined by the methods capable of accuracy of 0.001 percent and 0.5 percent, respectively of the volume of the sample.

NOTE—Testing method with pressure from -10 percent to +10 percent of the rated pressure is under consideration of the Committee and this clause shall be applicable after the establishment of the test method.

23 THERMAL EFFICIENCY

23.1 When tested as specified in Annex B, the thermal efficiency of different type of burners shall meet the following values:

<i>Sl No.</i>	<i>Type</i>	<i>Minimum Efficiency percent</i>
1.	M22 and T22	45
2.	M35 and T35	38
3.	M50 and T50	35
4.	M78 and T78	35
5.	V	38

NOTE — Gas burning rate of 'V' type burners of any length shall be 1.5 kg/h at a pressure of 34.323 kN/m² (0.35 kgf/cm²).

23.2 Thermal efficiency may be declared, if it is 4 points higher than the values specified in 23.1.

SECTION 3 GENERAL

24 MARKING

24.1 Each burner shall be legibly and clearly marked with the following:

- Manufacturer's name, initials or registered trade-mark;
- Rated pressure in kN/m² (gf/cm²);
- Rated gas consumption in g/h at rated pressure;

- d) Batch No;
- e) The words 'for use with LPG'; and
- f) Declared thermal efficiency, if it is higher than specified in 23.1.

24.1.1 The information given in 24.1 shall be distinct, permanent and easily accessible when the burner is assembled to an appliance, which is installed as it would be in service.

24.2 BIS Certification Marking

The burners may also be marked with Standard Mark.

24.2.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

25 PACKING

25.1 The method for packing shall be such as to minimize the damage to the burner in transit.

25.1.1 All open ends and connection openings shall be suitably plugged, and sealed to prevent the entry of extraneous matter.

ANNEX A

(Clause 6.3)

METHOD FOR DETERMINATION OF SWELLING OF NON-METALLIC MATERIALS

A-1 PROCEDURE

A-1.1 Weigh a piece of material under examination in air and then in water; and calculate the volume. Thereafter, immerse in pentane for 72 h at room temperature. In case liquid pentane is not available, immerse the piece in LPG in a sealed container capable of withstanding the vapour pressure of LP gas to be expected. After 72 h, withdraw the sample and allow to weather in air for 5 min and reweigh in air and water for estimation of volume.

In case of loss of weight, care shall be taken not to confuse it with the removal of small bits of grease, which may have been present in the sample under test. If this is suspected, perform the test on two samples, wash one of them for a few minutes in liquid pentane before commencing the test. If deterioration in the properties of the compound are suspected as a result of loss of weight, then dismantle all the components, subject them to the test as described above and then reassemble and test for operation in the usual way.

ANNEX B

(Clause 23.1)

THERMAL EFFICIENCY TEST

B-1 PROCEDURE

B-1.1 The test shall be carried out by weighing the gas used. The gas shall be taken from standard supply LPG cylinder for domestic or commercial use.

B-1.2 The number of cylinders to be used for the test shall equal the burner consumption rate in kg/h, rounded off to the next higher integer.

Where only one cylinder is required, an adaptor shall be fitted to the cylinder valve. An 'ON/OFF' valve shall be fitted downstream of the adaptor. This valve shall be positioned as near the adaptor as possible. A pressure regulator shall be fitted downstream of the valve.

Where more than one cylinder is required a cylinder manifold shall be provided.

B-1.3 The outlet pressure of the pressure regulator shall be equal to the manufacturer's recommended

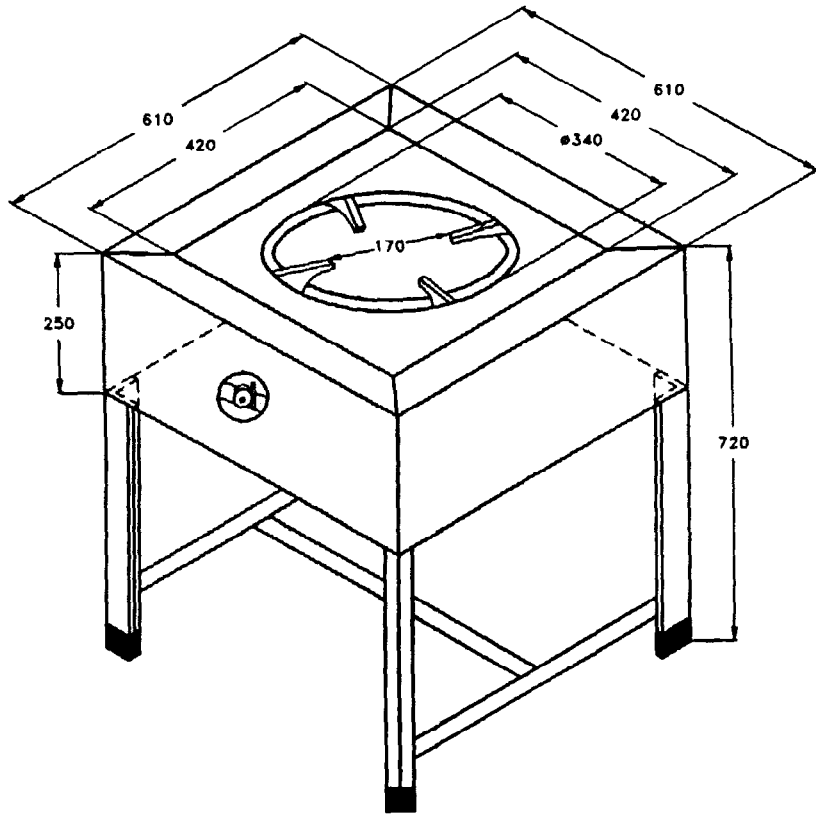
burner inlet pressure. Tests shall be carried out for the gas burning rate at a gas pressure of 34.323 kN/m² (0.35 kgf/cm²).

The burner to be tested shall be assembled in the test appliance according to manufacturer's recommendations. Dimensions of this test appliance for 'M' and 'T' type burners shall conform to Fig. 4. Manufacturer shall declare the dimensions of pan supports and the distance between top of the burner to top of the pan support (bottom of the vessel).

Test appliance and other required details for 'V' type burners shall be declared by the manufacturer.

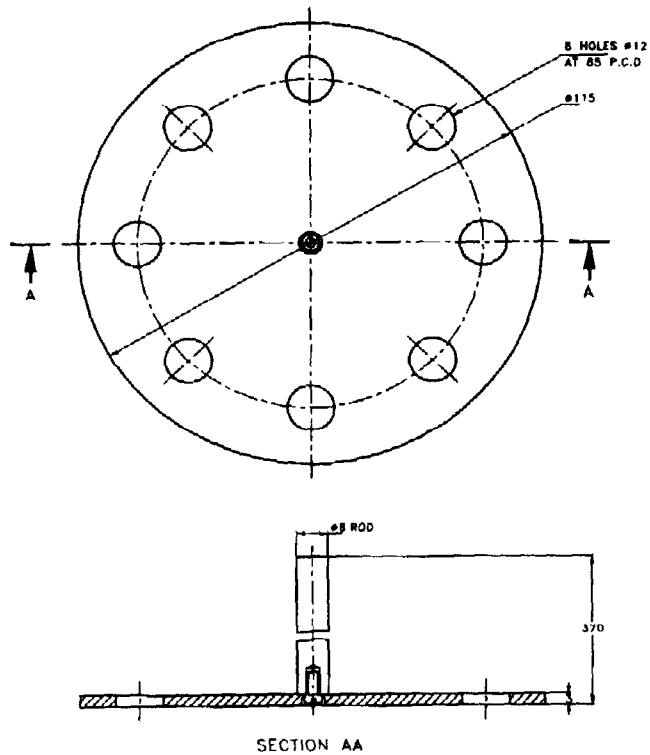
A pressure gauge of suitable range shall be fitted between the regulator and the burner.

B-1.4 The gas shall be passed through the burner for a few minutes to purge the system and to establish the gas pressure required. Only one burner shall be tested at a time and during the test, all gas delivered



All dimensions in millimetres.

FIG. 4 DIMENSIONS OF TEST APPLIANCE



All dimensions in millimetres.

FIG. 5 STIRRER FOR THERMAL EFFICIENCY TEST

from the cylinder(s) shall flow through the jet(s) of the burner being tested. The pan shall be selected and filled with water in accordance with the requirements given in Table 1 and Table 2, and placed centrally over the burner being tested.

The water temperature (t_1) shall be noted and recorded as long as it remains constant. The cylinder shall be disconnected after closing the 'ON/OFF' valve and the initial weight of the cylinder (W_1) recorded. Then the cylinder shall be reconnected and the 'ON/OFF' valve reopened. The gas control tap shall then be switched on and the gas shall be ignited. Stirring shall be commenced when the water temperature reaches 80 °C and continued until the end of the test. When the water temperature reaches 90 ± 1 °C, burner tap and 'ON/OFF' valve shall be switched off. The stirring shall be continued and temperature shall be recorded every 30s. Final temperature (t_2) shall be taken as the highest temperature recorded. The cylinder shall be disconnected and final weight of the cylinder (W_2) shall be recorded. The thermal efficiency of the burner shall be calculated from the following formula:

$$e = \frac{100 [M + M' \times 0.214] \times [t_2 - t_1]}{[W_1 - W_2] \times 10\ 900}$$

where

e = thermal efficiency of the burner in percent,

M = quantity of water in the vessel in kg,

M' = weight of the vessel in kg, complete with stirrer and lid,

t_1 = initial temperature of the water in °C,

t_2 = final temperature of the water in °C,

W_1 = weight of cylinder in kg before the test, and

W_2 = weight of cylinder in kg after the test.

B-2 In performing the thermal efficiency test, the following shall be noted:

- a) The set-up shall be carefully checked for leaks, before and after the test. If a leak is found after the tests, the results should be cancelled and the test repeated.
- b) The initial temperature of the room shall be between 20 to 30 °C. The water temperature shall be within ± 2 °C of the actual room temperature.
- c) The room shall be free from draught.
- d) At the start of the test, burner shall be at room temperature.
- e) The temperature of the water shall be measured by means of a mercury-in-glass thermometer of accuracy of 0.5 °C and the bulb of which is immersed to half the depth of the water in vessel. Alternatively any other temperature measuring devices shall be permitted.
- f) For insertion of thermometer, a hole of 8 mm dia shall be drilled into the pan lid at the centre and assembled with a suitable cork. The thermometer shall be inserted through a suitable hole drilled into the cork.
- g) Stirring shall be effected by means of two disc type stirrers (*see* Fig. 5) fitted symmetrically and attached to an upright which passes through a 8 mm hole drilled in the lid. Stirring may be effected by mechanical means. The lid shall be clamped with pan to avoid spillage.
- h) Least count of weighing balances used shall be 10 g or better.
- j) Specific heat of aluminium is 0.214.
- k) If the net calorific value of gas used is not determined experimentally, the value may be taken as 10 900 kcal/kg for calculation.

**Table 1 Vessels for Thermal Efficiency Test
(for M and T Types)
(Clause B-1.4)**

Sl No.	Burner Type	Gas Burning Rate in kg/h	External Diameter in (mm) $\pm 5\%$	External Height in (mm) $\pm 5\%$	Mass of vessel and lid in kg $\pm 10\%$	Mass of water in kg
1	T22, M22	1.000	380	205	2.560	16.50
2	T35, M35	1.500	420	220	3.070	24.00
3	T50, M50	2.250	495	265	4.520	37.00
4	T78, M78	3.500	595	320	8.450	58.00

NOTES

- 1 Distilled water (*see* IS 1070) shall be used for test.
- 2 The pan shall be cylindrical with flat bottom.
- 3 The pan bottom shall have a bright finish from inside.
- 4 For burners having gas ratings above 3.5 kg/h, special pans shall be constructed to conform as far as possible with the principles used in formulating this table as given below:
For different LPG commercial burners of different burning rate, the criteria for selection of different vessel size and water quantity is based on identical testing time (approximately 17 min). The ratio of total water equivalent to gas burning rate shall be 17 ± 0.5 .

**Table 2 Aluminium Pans for Thermal Efficiency Test
(for V Type Burners)
(Clause B-1.4)**

Length of Burner in mm \rightarrow Pan External Dimensions \downarrow	300	600	900	1200
Length <i>L</i> , mm $\pm 5\%$	450	750	1050	1350
Width <i>W</i> , mm $\pm 5\%$	300	300	300	300
Height <i>H</i> , mm $\pm 5\%$	225	135	100	75
Total mass of pan with Lid and Stirrer in kg $\pm 10\%$	3.530	4.210	5.110	5.960
Mass of water in kg	24.00	24.00	24.00	24.00

NOTES

- 1 Distilled water (*see* IS 1070) shall be used for test.
- 2 The pan bottom shall have a bright finish from inside.
- 3 The criteria for selection of different vessel size and water quantity is based on identical testing time (approximately 17 min). The ratio of total water equivalent to gas burning rate shall be 17 ± 0.5 .
- 4 Calculation of the mass of pan, lid and stirrer is based on 2 mm thick aluminium sheet. Stainless steel sheet may be used for the fabrication of the pan, lid and stirrer. Corresponding changes in mass and water equivalent shall be used for calculating the efficiency.

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Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Handbook' and 'Standards Monthly Additions'.

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Amendments Issued Since Publication

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